

III. Driving Forces

Changes in land use are the end result of a variety of forces that drive the millions of separate choices made by individuals and governments. In this chapter, the driving forces behind the trends in land use are carefully laid out in a way that shows the links between them at each step in the development process.

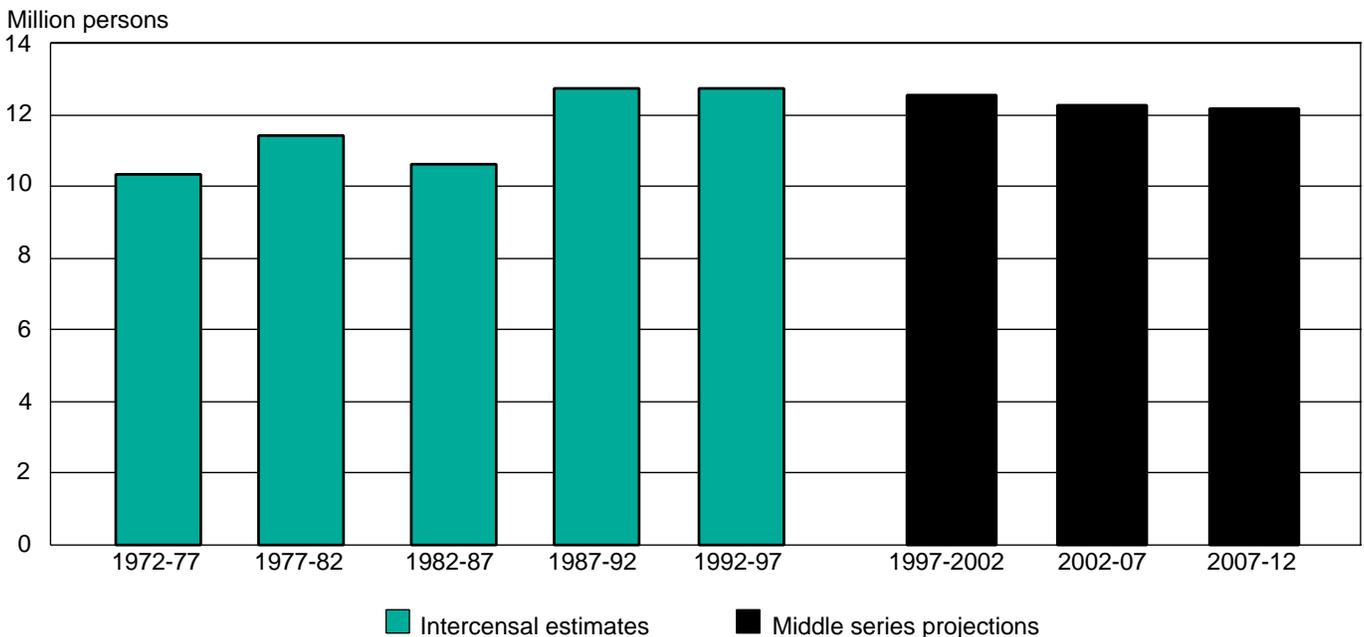
The forces that drive urban growth are well known and fairly well understood. The ultimate driver is population growth and household formation, which, when combined with growth in income and wealth, spurs new housing development and consumption of land for housing. Population growth in outlying areas is most often the result of redistribution of the metropolitan population, but may result from new influxes of population from outside the area. Metropolitan areas grow organically, like a living thing, with stages of growth that are palpable and predictable. After the new housing developments are built and occupied, the new residents realize they need new schools and improvements in the roads, sewers, and water supplies servicing the new housing; the expanded infrastructure then attracts more housing at higher densities. When a critical mass is reached, shopping centers and businesses follow the population, to serve them and to be closer to the labor force.

U.S. Population Growth and Household Formation

Almost alone among developed nations, the United States continues to experience a high rate of population growth, adding 1 percent per year to a large base population (Riche, 2000, p. 5). Population grew from 150 to 250 million people between 1950 and 1990 and is expected to add another 150 million by 2050 (U.S. Census Bureau, 2000). The number of people added to the U.S. population during 1987-92 and 1992-97 (each over 12 million) was the highest of any recent 5-year period, and the rate is expected to stay high (figure 5). Increasing immigration and higher life expectancy have helped maintain high growth levels. Immigration levels today are similar to those in 1900. Then, as now, about a third of new population was due to movement from abroad. Fertility levels have declined since the 1950's but remain higher than those in other developed countries: on average, U.S. women are currently bearing close to 2.1 children, the number necessary for a population to replace itself, compared with 1.6 children per woman in Europe.

Household formation (marriages, divorces, moving out) and the demand for new land for housing is affected by population growth, but is also strongly influenced by

Figure 5
Additions to U.S. population, 1972-2007



Source: U.S. Census Bureau.

social and cultural trends and economic conditions. Employment opportunities and increases in wealth affect how and when new families and individuals move into separate housing and when established families upgrade to larger houses. Thus, the rate of household formation, and consequently the demand for land for new housing, fluctuates with cyclical economic conditions as well as long-term social and demographic trends.

Changing household size can have a bigger impact on the housing market and the demand for land than overall population growth. The rate of household formation has been outpacing population growth as average household size dropped from 3.7 in 1950 to 2.6 today; the same number of people now require up to 30 percent more housing (figure 6).

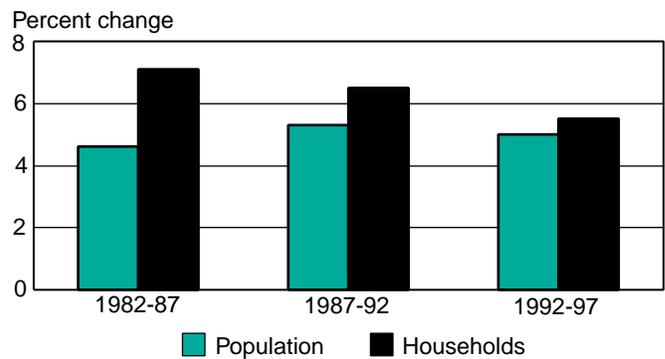
Growth in household formation increased in the early 1960's to a peak of 1.7 million per year in the late 1970's. Factors contributing to this peak included a downward shift in average household size in the 1970's when the baby boom generation entered the housing market, and a rapid increase in the elderly population. In the 1980's, housing demand began to shrink with the maturing of the baby bust generation (born during the low-birth years of the 1960's and 1970's); but during 1982-87, household numbers grew by 7 percent, while population grew by only 4.5 percent. With fewer young

adults and retirees creating a smaller pool of housing consumers (reducing especially the number of new, single-person households), household growth dropped to 5.5 percent during 1992-97 as average household size stabilized. Household formation in the 1990's averaged less than 1 million per year, rising late in the decade.

Household Land Consumption

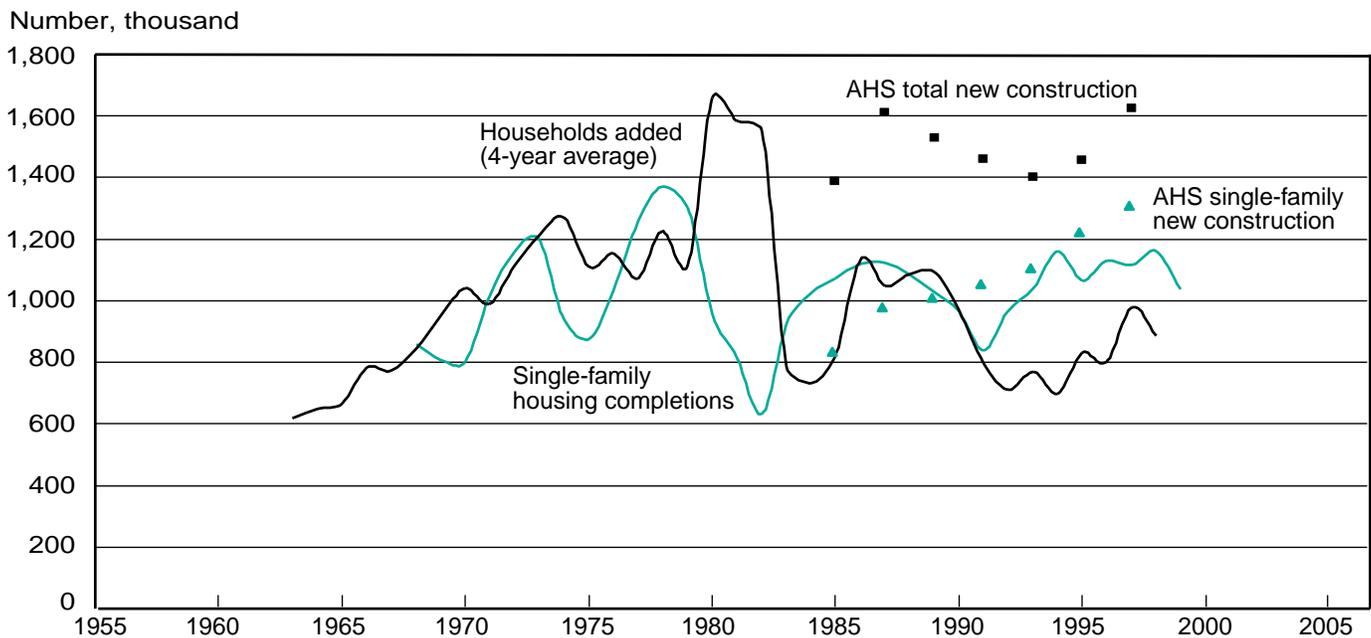
The total number of housing units completed mirrored household formation, with peaks in the mid-1970's, late 1970's, and mid-1980's (U.S. Census Bureau, 2000c; figure 7). These data are from developers and largely reflect tract housing, primarily built at the urban fringe. However, household formation in the 1990's averaged

Figure 6
U.S. population and household change, 1982-97



Source: U.S. Census Bureau.

Figure 7
Household formation and housing completions, 1960-97



Source: ERS analysis of U.S. Census of Population, Construction Series C-22, and American Housing Survey data.

826,000 per year, but total new construction averaged about 1.5 million units per year, with single-family new construction at more than 1 million per year.

Household formation and housing construction are often out of sync when poor economic conditions prevent new households from purchasing new housing (such as 1968-1971, 1974-78, and 1980-83 in figure 7), followed by better times when pent-up demand is met (1976-79, 1983-87, and since 1992). Data from the American Housing Survey also show that total new construction (including apartments, condominiums, and mobile homes) followed the pattern of household change, and mirrored housing completions recorded in Census housing construction statistics (USDC, 1999). However, single-family housing reported in the American Housing Survey (AHS) rose from the mid-1980's through the 1990's. Thus, new housing outstripped basic household formation, particularly in the kind of housing likely to be built in exurban locations. Favorable economic conditions drove homeownership to a record high of 66.8 percent in 1999, with over 8.7 million new home-owning households since 1992 (U.S. HUD, 2000, p. 58). While central city homeownership also increased to 50.4 percent, many of the new homes are in outlying areas.

Average lot size for new single-family houses has decreased for much of the new housing built in urban areas and the urban fringe, as new owners turn to condominiums, townhouses, and larger houses on smaller lots. The average lot size of tract housing dropped from 0.4 acre in the mid-1970's to 0.3 acre in the 1990's.

Median lot size in the American Housing Survey has been about 0.5 acre, dropping slightly from the late-1980's. However, the average lot size has increased to almost 2 acres because of growth in large-lot housing of 5 and 10 acres or more. Much of this large-lot construction has occurred beyond the urban fringe and farther out in nonmetropolitan counties. Large-lot housing, as a proportion of new construction in rural areas, rose from 40 percent in 1980-93 to 45 percent in 1994-97. Median lot size of new construction in central cities was 0.23 acre, but averaged 0.78 acre, while median lot size outside Metropolitan Statistical Areas (MSAs) was 1.6 acres, and averaged almost 3 acres. While average land consumption per new housing unit decreased for most new housing added at the urban fringe, the amount of land consumed in relatively small numbers of new large-lot housing units located beyond the fringe grew. Most of the land developed for housing is

not urban, as defined by Census, but occurs beyond the urban fringe in largely rural areas.

Large-lot zoning is not entirely a matter of preference or markets. Zoning laws are part of the land-use guidance institutionalized by government and put constraints, either in terms of minimum or maximum lot sizes, on developers and consumers (Haar, 1976). Large-lot zoning, requiring a minimum lot size of 3 to 20 or more acres, was an early attempt to limit development (Coughlin and Keene, 1981, p. 21). Large-lot zoning is now recognized as being ineffective in reducing development, and actually contributes to significant loss of farmland. However, setting minimum acreages applying to subdivision control regulations that more actively guide development has inadvertently resulted in de facto large-lot zoning since developers can choose a lot size just above the minimum and avoid the more stringent controls. Subdivision control regulations are limited to parcels of 5 acres or less in Ohio, 10 acres or less in Michigan, and 25 acres or less in Colorado (Libby, 2000).

Demand for Low-Density Development

There is an undeniable appeal of extensive single-family housing development for the American people. Surveys ratify the prevailing U.S. consumer preference for single-family detached housing surrounded on all sides with yards (Fannie Mae, 1996). A 1988 survey showed that 70 percent of Americans preferred a rural or small town setting within 30 miles or more of a city over 50,000 in population (Fuguitt and Brown, 1990). And, 35 percent of those living in a rural or small town more than 30 miles away from a city stated a preference for the same type of setting within 30 miles. So pressure on fringe development in the form of stated locational preferences comes from both ends of the rural-urban spectrum. The survey was repeated in 1992-93 and confirmed the initial findings. While most people prefer the residence situation they are living in, those who would rather live elsewhere are more likely (by a 2 to 1 margin) to prefer a less densely populated setting (Brown et al., 1997).

Surveys undertaken by the Federal National Mortgage Agency (Fannie Mae Survey of Residential Satisfaction of Housing Occupants) during the mid-1990's reveal that personal open space is highly desired by most Americans. In terms of buying preference, single-family detached housing was more popular during the mid-1990's than it was a decade earlier. In the Novem-

ber 2000 election, anti-sprawl measures in Arizona and Colorado were opposed by 70 percent of voters (*Washington Post*, November 10, 2000).

As metropolitan areas grow in population, there are only two basic choices for urban form: grow outward at similar or lower densities, or grow upward at higher densities. Beyond a certain size, an urban form with multiple centers is more efficient than a compact, highly centralized monocentric form, because it allows the clustering of land uses to reduce trip lengths and congestion (Haines, 1986; Steiner, 1994). What has been called the “New Urbanism” is a school of urban design that counters conventional suburban development in favor of design elements that mimic features of small towns (Chen, 2000; Duany et al., 2000). These developments emphasize a more traditional grid layout, walkability, and more compact design. Some new developments designed using these principles in Florida, Virginia, and Kentucky have been commercially successful.

Potential benefits from lower density development at the city’s fringe include access to employment, access to open space amenities, lower crime rates, lower housing costs, better air quality, more flexible transportation by auto, and preferred separation of residences from commercial and industrial activities (Gordon and Richardson, 1997; Peiser, 1989).

The most obvious benefit is that low-density development in rural areas has allowed many people, including those who cannot afford city real estate, to buy single-family homes because land costs are cheaper on the fringe than in the core. Many people are willing to pay both the private and social costs of such auto-dependent development in exchange for the automobile’s comfort, flexibility of use, low door-to-door travel time, freight-carrying capacity (for shopping trips), and cheap long-distance travel, as well as the aesthetic benefits of separated land uses associated with such development (U.S. OTA, 1994). Benefits to society include increased location options for businesses, greater consumer access to shopping centers and superstores with greater economies of scale and lower prices, and commuter freedom from dependence on the timetables of public transit systems, allowing more flexible work schedules. Decentralizing both homes and work may decrease some commutes, saving both time and energy (Gordon and Wong, 1995). So far there is no evidence this has happened, mostly because of increased cross-commuting between one suburb and another (Downs, 1994).

Low density and fragmentation, it is argued, are not problems because leaving parcels of land undeveloped in the urban area in the short run will increase land densities over the long term, as these parcels increase in value and, eventually, become developed for more intensive use. Peiser (1989) examined this hypothesis in Fairfax County, Virginia; Dallas, Texas; and Montgomery County, Maryland. Montgomery County did not show evidence of infill development because its land-use regulations do not allow higher densities on the leapfrogged parcels. The infill parcels in Fairfax did generally conform to the hypothesis with higher densities, and the results from Dallas were mixed.

Residents may also enjoy air quality improvements from decentralizing population and employment. Bae and Richardson (1994) note that greater automobile use does not necessarily lead to worsening air quality. Lower per capita emissions at high densities have more environmental impact than higher per capita emissions in a low-density environment because of the ability of local airsheds to absorb pollutants, and the fact that pollution levels increase exponentially, not linearly, as the percent of capacity absorbed rises. Automobile pollution is more strongly related to the number of trips and to the hours of driving, rather than to the length of each trip in miles. A major part of auto pollution derives from cold starts. A recent study in San Diego found that by balancing jobs and housing, a 5- to 9-percent reduction in miles traveled would reduce traffic congestion by 31-41 percent, but vehicle emissions would be cut by only 2 percent (San Diego Assn. of Govts., 1991). The New Jersey State Planning Agency found that a more compact urban development scenario did not significantly improve air quality over that in low-density development (Burchell, 1992). New Jersey officials found that improvements in air quality from cleaner fuels, more efficient engines, more stringent emission inspection, and more cars with anti-pollution devices dwarfed any improvements derived from land use.

Metropolitan Expansion

The concentration of population into ever-expanding urban centers was the most important development in population distribution in the first half of the 20th century. While rural people moved into metropolitan areas, the dense populations of central cities emptied out into the surrounding countryside. The automobile helped trigger both a rural-to-urban migration, and a city-to-suburb relocation, resulting in settlement patterns today that conform more to commuting, recreation, and

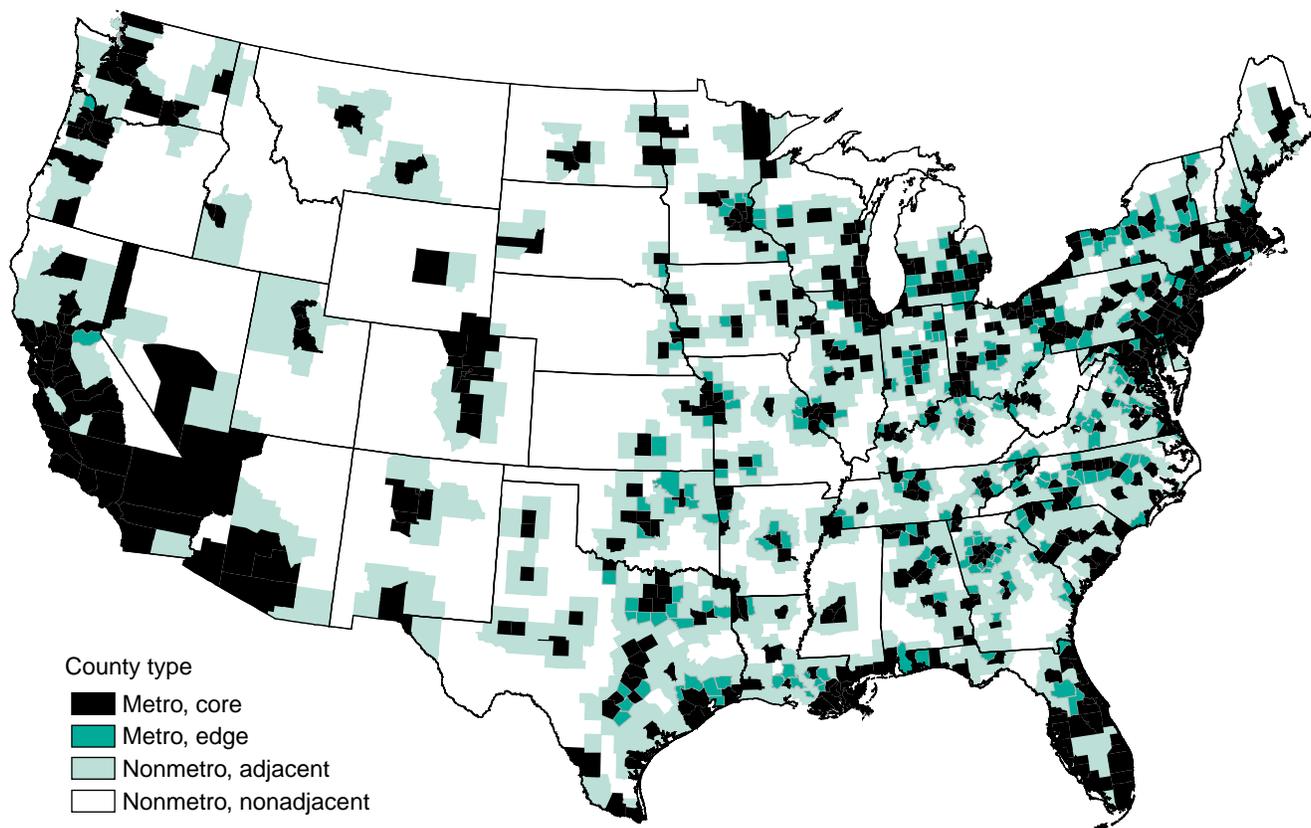
retirement than to farming, mining, or logging. Many areas once entirely rural have been absorbed into thriving metropolitan regions. Retail centers and office parks have followed housing out to the urban fringe, greatly expanding commuting patterns. Urbanized areas, including the central cities and adjacent, densely settled territory at the core of metropolitan areas, have grown in number from 106 to 369, since 1950, nearly quintupling in area to 39 million acres (1.7 percent of total land area). The same number of people now require more land: Population density in urbanized areas has dropped by more than 50 percent, from 8.4 to 4 people per acre over the last 50 years (U.S. HUD, 2000; U.S. Bureau of the Census).

Changes in the U.S. settlement pattern have combined population concentration into metropolitan areas and population deconcentration toward the metropolitan fringe and nearby nonmetropolitan territory (U.S. HUD, 2000). Metropolitan population grew at more than twice the rate of nonmetropolitan areas in the 1950's and 1960's and again in the 1980's. The expan-

sion of the interstate highway system, the extension of public utilities, advances in telecommunications technology, the availability of standardized consumer goods, and life-style changes oriented toward lower density settings laid the groundwork for expanded non-metropolitan growth in the 1970's. These advantages gave way temporarily under economic recessions, a farm debt crisis, movement of manufacturing jobs overseas, and other "period" effects in the 1980's. The 1990's witnessed a rebound in growth outside metropolitan areas, and rural experts once again are predicting a permanent, gradual dispersion of the population, brought about by improved transportation, telecommunications, and other technological innovations (Johnson, 1999c).

The highest rates of population growth are occurring at the edges of metropolitan areas, in the predominantly rural counties that have already been absorbed into the metropolitan area through increased commuting (figure 8). Population growth at the metropolitan fringe increased from 7.1 percent during 1982-87 to over 10

Figure 8
County typology, 1990



Source: USDA, ERS analysis of data from the U.S. Census Bureau.



percent during 1992-97, while growth in the metropolitan core dropped (figure 9). Adjacent nonmetropolitan counties now have a higher rate of growth than metro core areas as people move even farther out in search of less expensive land for housing. Areas far removed from metropolitan influence lost population during the 1980's, but in the 1990's entered a period of general population gain.

Dynamics of land-use Change

Urbanization of rural land is a dynamic process that, despite its chaotic appearance at any particular moment, occurs in regular spatial and temporal patterns that are clearly distinguishable to anyone who has watched a city grow over time. Starting at the historical origin of any metropolitan area (New York's battery, Chicago's lakefront, or Denver's original pueblo), growth expands outward at the urban periphery. The dense, inner city neighborhoods of today were the market gardens and farms of the former city, and the inner suburbs of any metropolitan city were rural lands developed in the decades after the city's initial growth began.

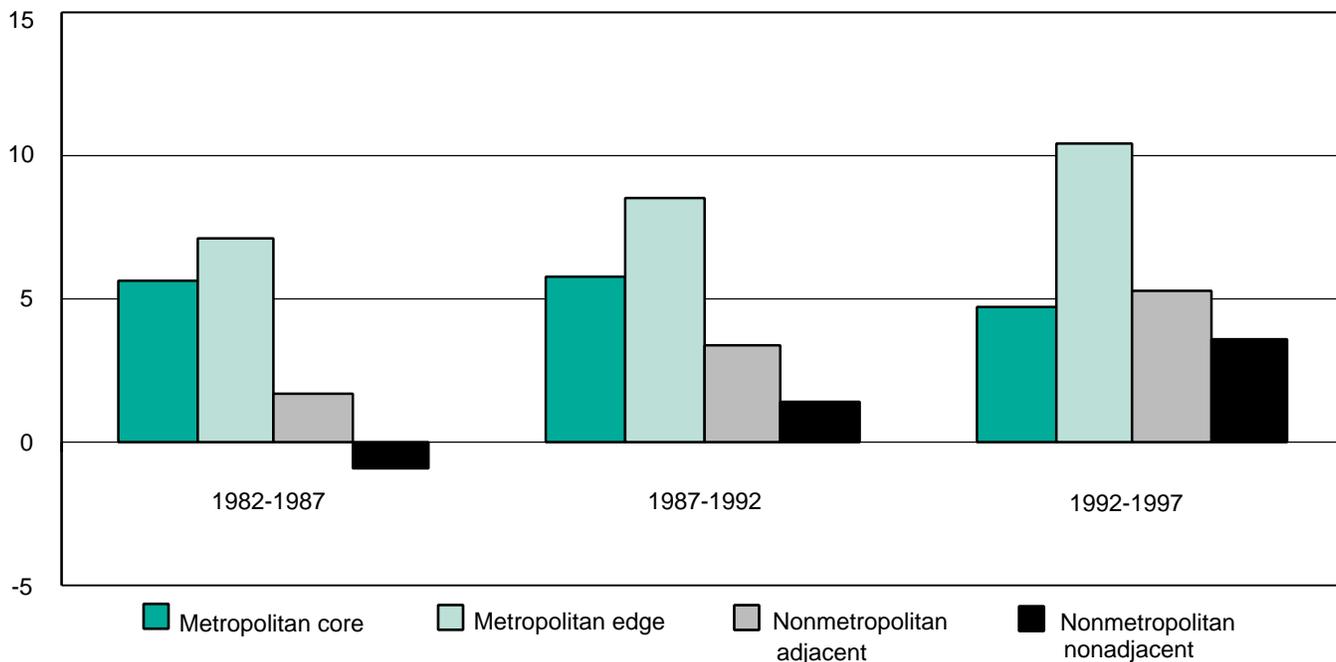
The German land economist Von Thunen recognized that rural areas surrounding cities arranged themselves in concentric rings of decreasing development intensity because of declining bid rent surfaces reflecting the

value to agriculture of proximity to urban markets (Sinclair, 1967; Brooks, 1987). Transportation and communication improvements in the 20th century transferred this same sorting to developed uses. The value of land declined with distance from the city center as people sought their own place on the continuum between rural amenity and urban access that plays out on every radius leading from downtown (Sinclair, 1967; Alonso, 1968; Brooks, 1987). The natural distortions of mountains, bays, and rivers, and those imposed by transportation arteries, result in the zones of decreasing development surrounding every metropolitan center (Fales and Moses, 1972).

What may be less obvious in any snapshot of the city is the dynamic element implied by this spatial pattern. As a city grows in population and spreads out seeking less dense and more amenable living arrangements, these zones also shift outward, creating Hart's "perimetropolitan bow wave" (Hart, 1976, 1991). Hart's case study of the New York metropolitan area (1991) showed that these outward shifts of population and development roll through the agricultural economy, affecting land rents, the amount of land in agricultural production, and the character of agricultural production. In the words of the U.S. Office of Technology Assessment (OTA, p. 99), "the historic dominance of the central city is giving way to a much more dispersed pattern of growth as

Figure 9
U.S. population change, 1982-97

Percent change for the period



Source: U.S. Census Bureau.

economic activity spreads unevenly throughout the metropolitan areas in other nodes and centers.”

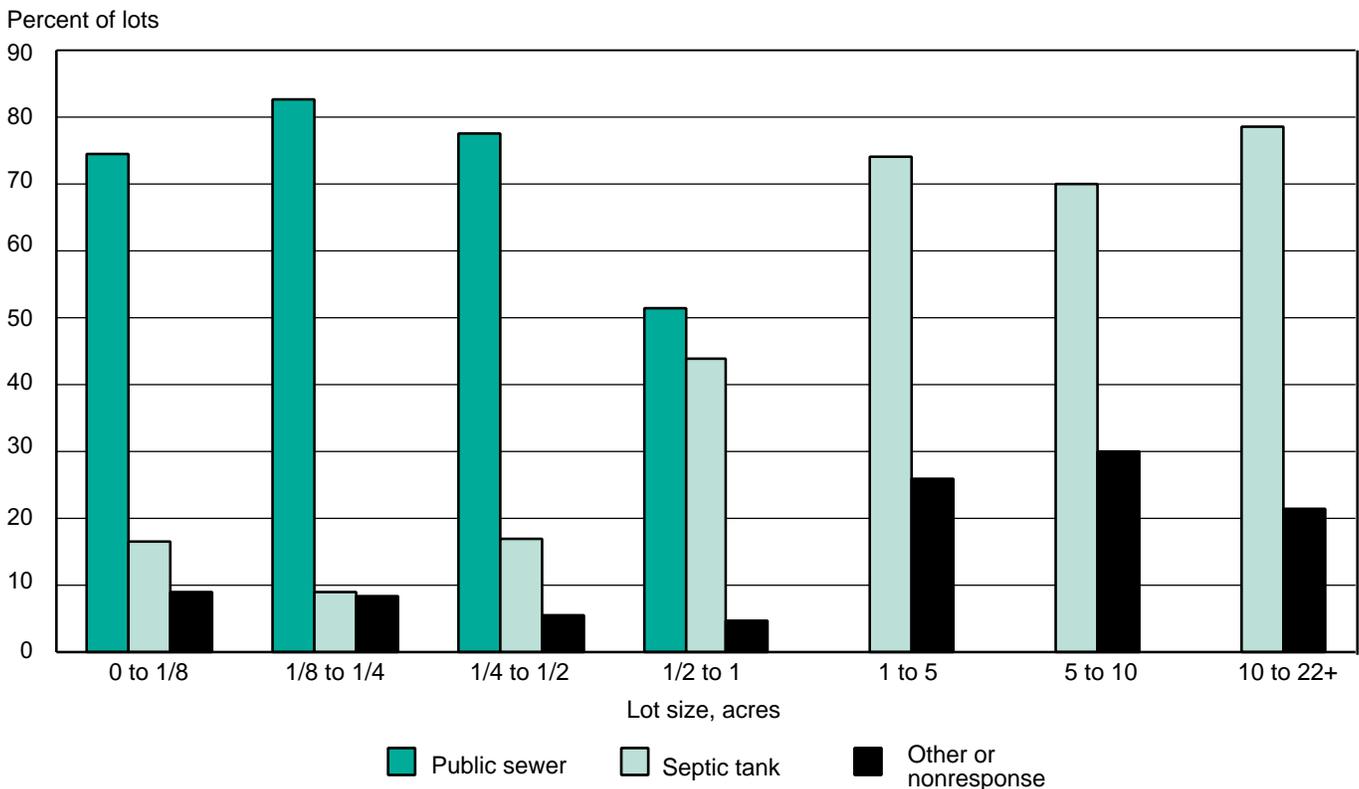
Economic theory suggests a partial explanation for the increasingly diffuse settlement pattern that develops from technological innovation. New technology lowers the cost of communication and transportation, driving higher land prices farther out into rural areas, and increasing the size of the urbanizing area. Advanced telecommunications capabilities, such as the Internet and cable, are already available in many areas of the country, but there are currently significant gaps in its availability in some States and rural areas. However, these gaps are expected to diminish over time. Eventually, when access to the urban center through communication and transportation technology is nearly effortless, the development value of land completely overshadows the value for agricultural purposes. People will then choose where to live based entirely on the amenities offered by the various locales. This is not especially unrealistic: consider airline pilots (who fly free on employing airlines) who may live in Seattle, but “commute” weekly to Dallas or other distant cities. Writers and others whose production process does not

require urban contact for long periods of time are free to seek living space rich in amenities. Knowledge-based companies in the new economy bring this freedom to more and more employees.

Infrastructure

Investments in infrastructure, such as roads, sewers, and water supplies, can be one of the most important drivers of urbanization, since infrastructure provides the essential framework for development. There is, however, a dynamic to infrastructure investment that affects land-use change. At the very edges of urban development in metropolitan areas, construction of new homes depends on private wells and septic systems. Under these conditions, house lots may be required to be sufficiently large to ensure that wells are not contaminated and that adequate area is allowed for septic drainage fields, thus consuming larger-than-average amounts of land per household. New single-family house data from 1997 show that half the lots between half an acre and 1 acre were not sewered, and nearly all lots greater than 1 acre were not sewered (figure 10). The percentage of lots on public water supplies

Figure 10
Sewage disposal by lot size, 1994-97



Source: American Housing Survey data in Peterson and Branagan, 2000.

dropped below half for lots greater than 1 acre (figure 11).

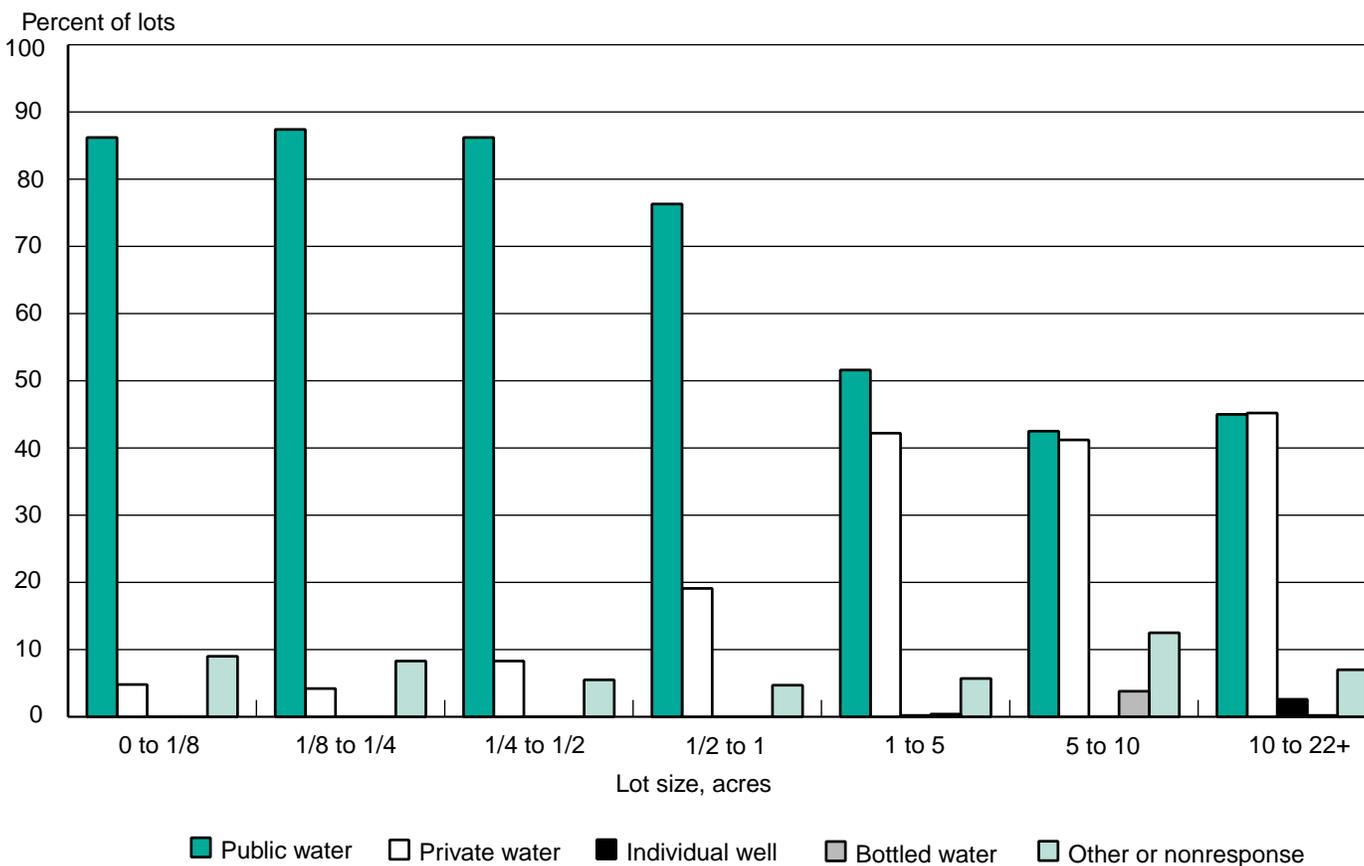
As sufficient development occurs, one of the first demands of new rural citizens is for road improvements, which often fuel even more development. At another critical mass of development, public health pressures motivate replacement of private wells with public water supplies. Sewer service, and especially trunk sewer lines, are the last infrastructure investments to occur. These facilitate full-blown developments, often at density levels comparable to inner suburbs as infill development occurs.

A study in Maryland showed that highway construction was a key factor in growth, with new roads preceding migration outward from the cities (Heavner, 2000). Extension and upgrading of automobile transportation networks is both demanded as the negative impacts of growth become manifest in congested highways, and contributes to the further growth that will spawn the

next generation of complaints. Road building is, at the interstate and primary highway levels, a joint effort of local, State, and Federal transportation authorities. Interstate highways, in and of themselves, offer little incentive for development. However, where there are numerous interchanges and a widening network of feeder and tributary road construction, and growth is not controlled, development is inevitable.

Once again, there is a dynamic to this infrastructure investment. In the most remote corners of the metropolitan area, existing, narrow, two-lane roads are the first channels for new development at low densities. At some point, a critical mass of citizenry is in place to demand upgraded and improved road systems, which soon generate additional development pressure. The pressure for new and improved interstate and primary highways can often propagate in reverse as focal points of development generate sufficient traffic to justify changes to these top-level systems.

Figure 11
Water supply by lot size, 1994-97



Source: American Housing Survey data in Peterson and Branagan, 2000.

Thus, while provision of infrastructure investment is almost always a clear inducement to urban development, its absence is usually not enough to curtail development. "Adequate facilities laws," which explicitly stage infrastructure investments and simultaneously restrict unserved development, may be the best way to use the leverage of infrastructure to control growth.

Employment, Economic Development, and Technology

Face-to-face contact has been the main factor behind the attraction of the city center for employment (Sinclair, 1967; Alonso, 1968). Developments in information and communication technology have been a major driver in the recent U.S. economic expansion. The United States, like other industrial economies, is in the midst of a technological revolution. In recent years, society has embraced cellular (wireless) phones, video phones, pagers, e-mail, call-forwarding systems, voice messaging, facsimile machines, the Internet, local and wide-area networks, optical scanners, barcode readers, fiber optics, data transfer protocols, digital switching, satellites, and portable computers. Based on advances in microelectronics, these innovations are directly altering telecommunications, information, and transportation technologies, and indirectly reshaping America's cities. An array of even more sophisticated microelectronic technologies, including high-definition images, high-speed, high-capacity Internet connections, and wireless computing and data transfer, already on the consumer horizon, conceptually have the potential to further reduce the importance of center cities.

Clearly, the Internet has not been widely available long enough to change development patterns to any noticeable degree . . . yet. Internet access and cable are not currently uniformly available. This may change if wireless Internet access is widely deployed, because high-speed fiber optic wiring is currently a limiting factor in many areas. Rapid adoption of these innovations can be compared with earlier innovations including electric power, automobiles, and television (Levitt, 2000). The new technologies may not only increase productivity, but may transform how firms do business, the way they compete, and the nature of work (*Economic Report of the President*; Horan et al., 1996). New technologies have changed the economics of locational decisions, both for consumers and businesses, and are facilitating the existing trend toward a more dispersed economy. Because these technologies reduce the frictions of space and time, businesses and people are freer to

choose where they locate, no longer as tightly tethered, economically and functionally, to the major metropolitan core. Just how "footloose" these businesses and employees become depends on how many and which business functions are transformed into electronic flows, how much activity still requires face-to-face interaction among suppliers, customers, and competitors, and the path of future technological change.

Although the new technologies will technically enable firms and residents to disperse to rural areas, they are more likely to relocate both to lower cost metropolitan areas and to suburban and exurban locations within metros. The Office of Technology Assessment (OTA), in its comprehensive review of the impact of communication and information technologies on human settlement patterns, concludes that "a limited number of high-amenity rural areas and rural areas at the periphery of metropolitan areas may experience significant growth..." but "at least in the foreseeable future, most of the economy will be locating in metropolitan areas, perhaps not the largest, highest-cost metros, but the next tier of mid-sized metros" (U.S. OTA, p. 6).

The concept of telework has obvious appeal, suggesting that large numbers of workers may be able to avoid the negative aspects of urban congestion, while at the same time enjoying lower real estate costs, lower property taxes, and more rural residential settings. Widespread adoption of telework would accelerate the trend toward dispersed land-use patterns (U.S. OTA, 1995, p. 171; Kunar, 1990; Horan et al, 1996). But OTA concludes that "those who think of telecommuters living in idyllic, remote locations are generally thinking of fulltime telecommuters. Most experts expect that fulltime telework is unlikely to result in a widespread shift of households to rural locations" (U.S. OTA, 1995, p. 172).

The trend in job growth on the urban fringe for much of the last 50 years was strengthened by the preponderance of high-tech job growth in the suburbs engendered by the so-called "New Economy," or high-technology, companies (figure 12). A recent HUD report finds that larger metro areas in all parts of the country lead the Nation in high-tech jobs. High-tech jobs, including the occupational classifications of telecommunications, science, and research and technology, accounted for 9.3 percent of job growth in the suburbs, and increased at twice the rate of 1992-97 overall job growth in the suburbs. In 1997, 57 percent of metropolitan area jobs were located in the suburbs, a 17.8-percent increase since 1992 (HUD, 2000). With access to more skilled,

college-educated residents, especially women ready to return to work, suburban firms can fill positions faster at lower wages. As technology plays an increasingly larger role, labor quality becomes more important for firms, and firms are more likely to meet their skill needs in the suburbs. New technology enables greater economies of scale by reducing the constraints of distance on business operations, letting them serve more customers and a wider area from fewer locations. Business service facilities have consolidated into fewer, larger service centers. Taken together, the decreasing need for physical proximity and the consolidation of activity into larger operations both favor suburban locations on the edge of fast-growing metro areas.

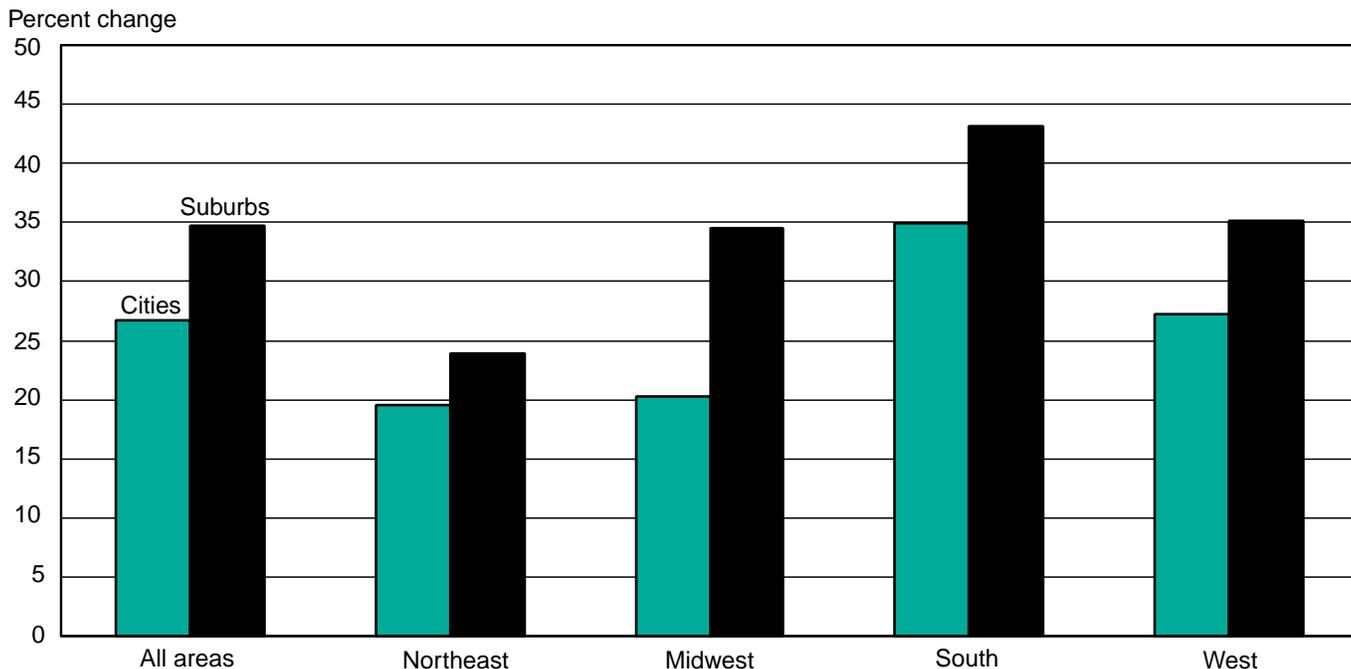
Confirming evidence of suburban job growth comes from the U.S. Conference of Mayors 2000 survey showing high-tech jobs growing 20 percent faster in Northwest suburbs than in cities, 60 percent faster in suburbs in the Midwest than cities, and 25 percent faster in suburbs in the South than in the cities. According to Hirshhorn (2000, p. 7), suburbs are now home to 60 percent of office space nationwide. That is an increase of 25 percent since 1970. The rise of high-tech corridors outside cities, such as Silicon Valley, Route 128 in Boston, and the Dulles Corridor near Washington, DC, illustrates the phenomenon of new high-tech

growth (Conference of Mayors, 2000). These high-tech corridors have begun to spawn outlying employment growth centers even farther out in the rural hinterland, such as Loudoun County, Virginia, California's Central Valley, and southeastern New Hampshire.

In addition, many of the New Economy companies, no longer economically and functionally tethered to major metropolitan areas, are locating in suburban areas of small cities in less populated States. Long-distance and 800-number services are examples, like Citigroup's back office credit card functions in Sioux Falls, SD.

The search for quality-of-life characteristics is of particular significance to the location decisions of knowledge-based, New Economy companies. The relatively small pool of highly skilled New Economy employees can perform their jobs nearly anywhere, providing unprecedented choice about where to live and work. More traditional criteria, such as salary and cost of housing now appear to be less important than quality of the environment (Hirshhorn, 2000, p. 23). To attract these highly skilled employees, companies must locate where many intangible amenities contribute to quality of life. Fortunately, the knowledge-based nature of their products also allows New Economy companies to locate nearly anywhere they wish. These companies are

Figure 12
High-tech jobs grow more slowly in cities than in suburbs, 1992-1997



Source: U.S. Department of Housing and Urban Development, State of the Cities, 2000.

among the most footloose, and are increasingly locating in rural suburban or exurban locations.

Suburban job growth, while slower than suburban population growth, is compounding the pressure on land far out in the countryside. The number of suburban jobs has grown to satisfy employers' needs to, first, exploit the labor force that now lives in suburban locations, and, second, to provide services to the new suburban populations. The old central city/suburb commuting patterns have been replaced with a web of commuting between satellite city employment nodes and residential suburbs, and between outlying areas and these nodes.

Residential development reaches out earlier and farther than office and commercial development. In a 10-year study of development in Columbus, Ohio, and surrounding Delaware County, Hite et al. showed that residential development was largely completed before commercial and industrial development commenced. Almost all parcels that eventually were converted to commercial and industrial uses "survived" in rural uses for nearly the entire period before being developed, while more than 70 percent of the parcels converted to residential use were converted before nonresidential development began.